Fermilab

Amplitude of Beam Motion at Betatron Frequency

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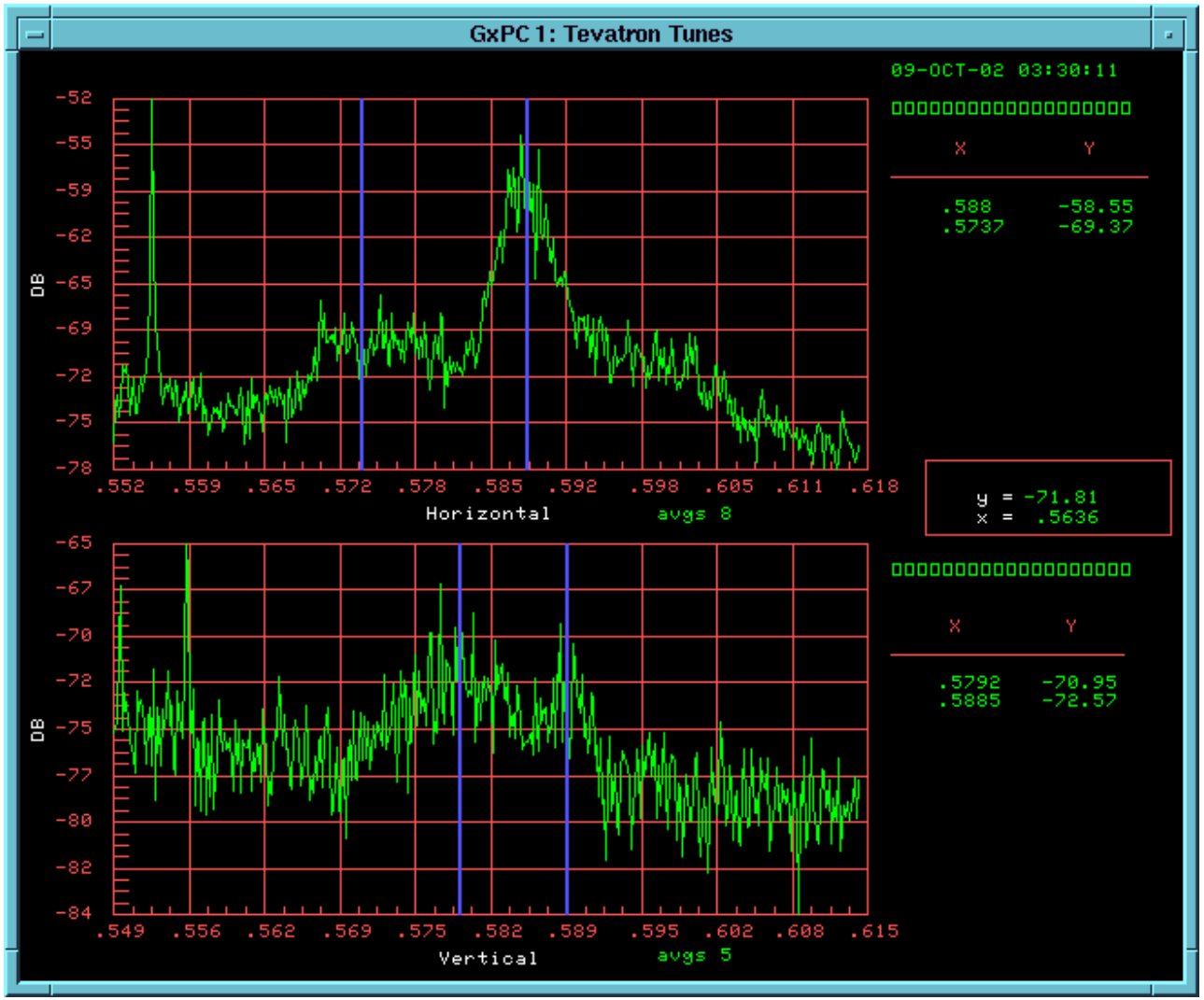
Staring at the Schottky Monitor:

500 um/

sqrt(3e11) =

=1 nm



We know it's not "real Schottky" signal, dominated by coherent motion

Sasha/Seva/Giulio's Setup VB11

Beta=900 m, scope 10 bit 4 GS/s

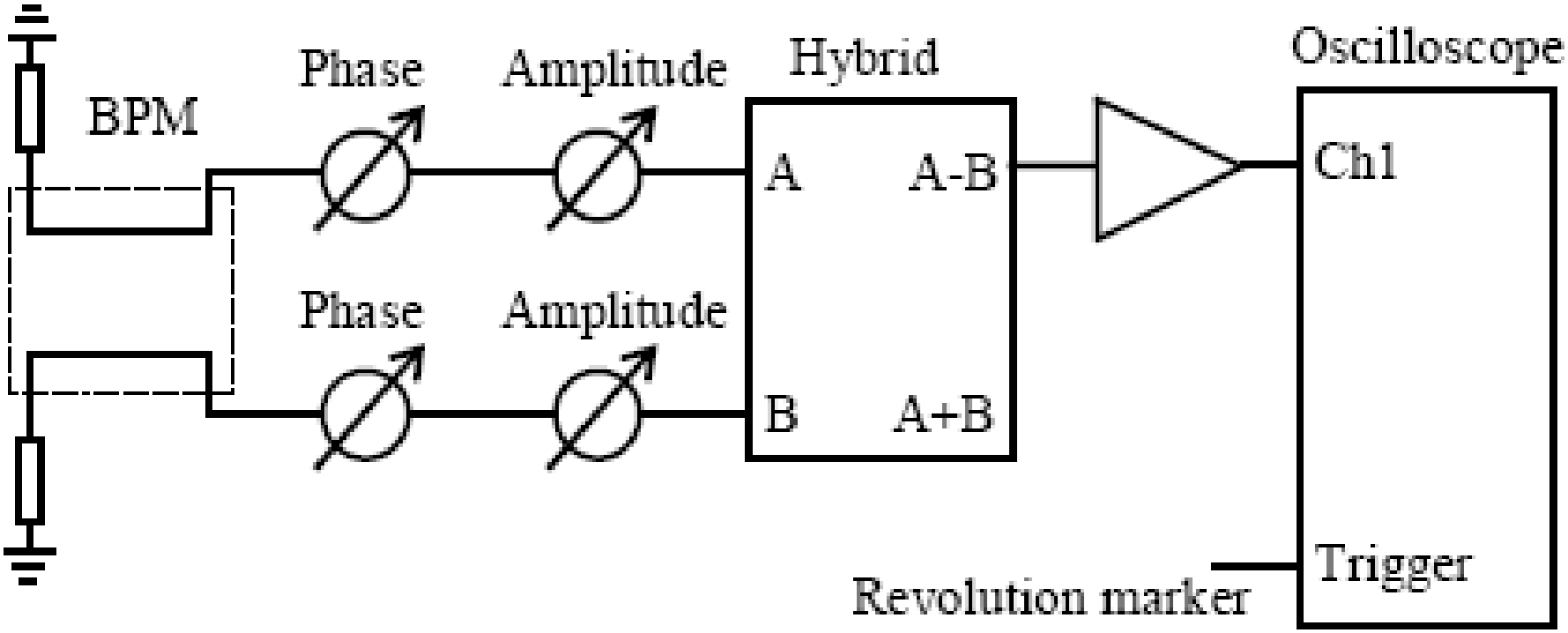
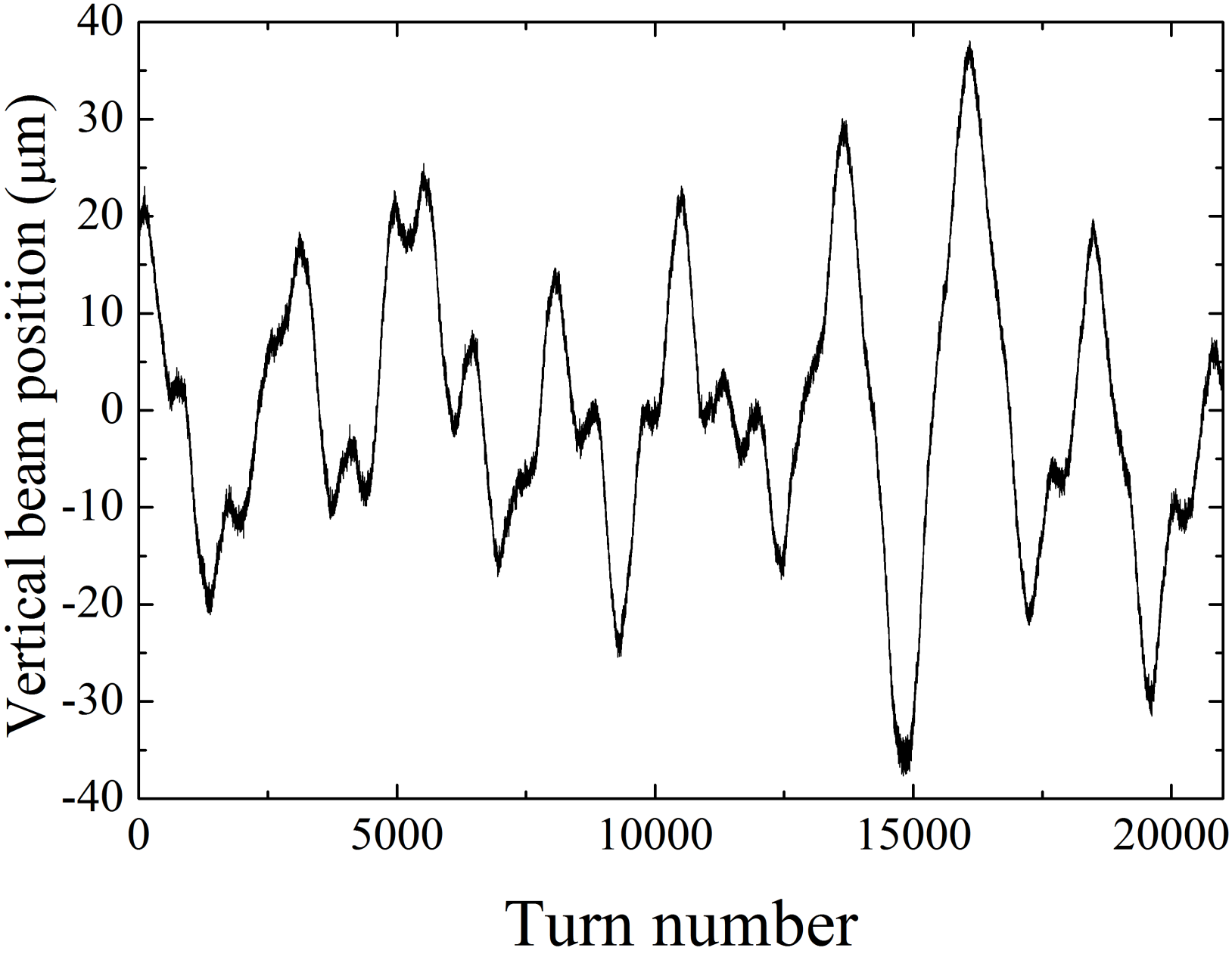


Figure 1. Block diagram of the measurement setup.

Raw data record

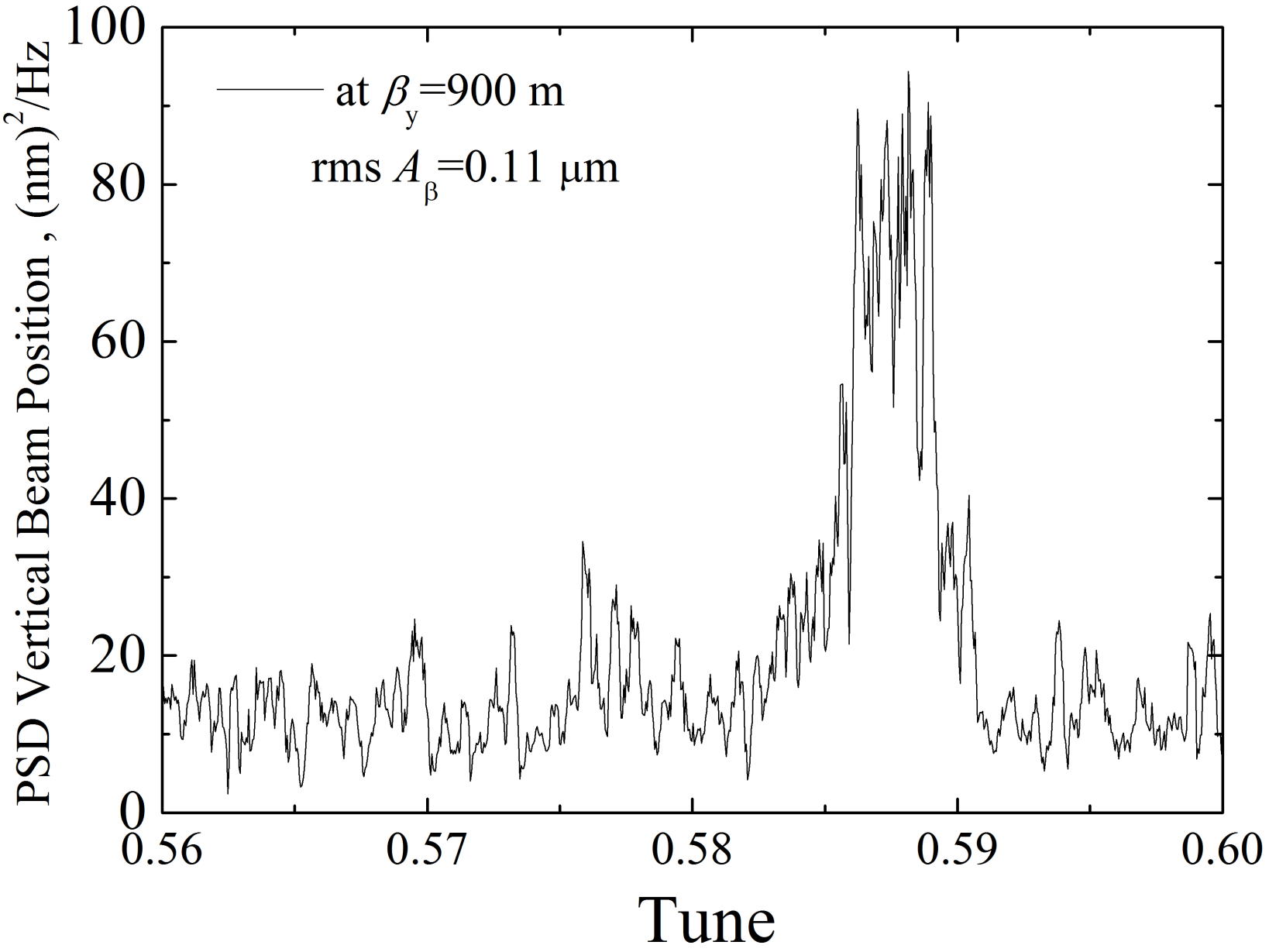


Recipe for Analysis

- Filter all harmonics except tunes 0.4-0.5 (FFT filter)
- Make FFT of the remaining signal
- Determine noise level
- Subtract it from the signal at the betatron line
- Determine signal level

The Result

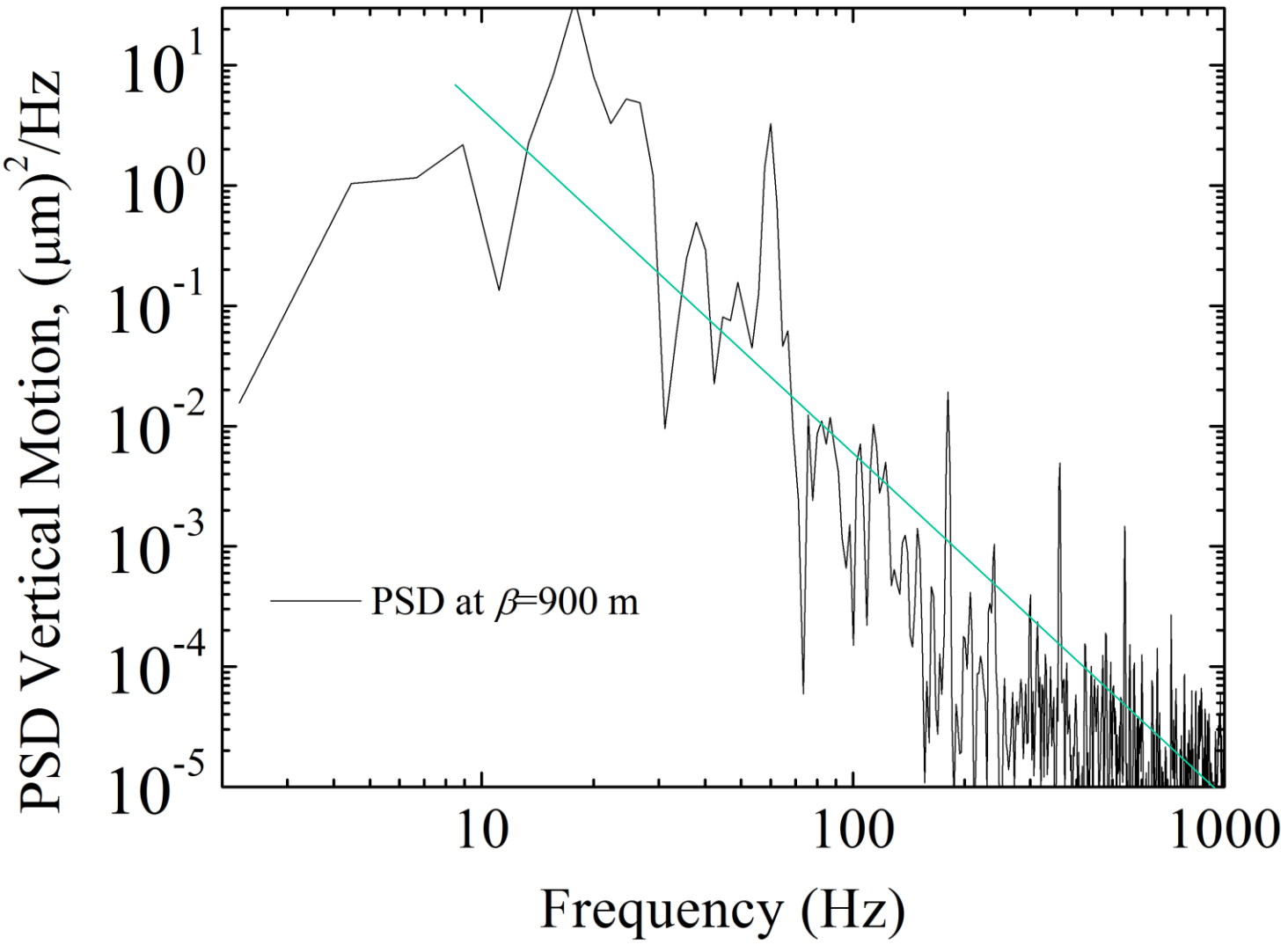
Note the units



Compare with other data

- That was the only data record which had significant signal/noise ration
- Usually, Schottky is 3-6 dB less (1.5-2 times)
- 110 nm at beta=900 m → ~30 nm at beta=60 m (Schottky)
- So, 15-20 nm in "normal store" at A24
- (about what Tan claims for BBQ)

Anther Result



We knew all that before : 4.6 Hzxm, 35 Hz, 60 Hz, 120 Hz, 180xn, etc

Summary

(if measured at beta=100m)

- Proton oscillations in stores ~+- 15 um al low frequencies

- Amplitude of motion at betatron frequency varies from ~10 to 30 nanometers

- Source of the betatron motion most probably is external noise (in which elements?)